# The Social and Economic Costs of Alcohol Abuse in Minnesota, 1983

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**Abstract:** Alcohol abuse in the State of Minnesota has an impact on health, health care resources, and the economy. Alcohol abuse was related to 3.3 per cent (1,150) of deaths in Minnesota in 1983; of these, almost one-third were the result of fatal injuries. Alcohol abuse contributed to 12 per cent (33,909) of all years of potential life lost, two-thirds of which were secondary to injury. The estimated cost of alcohol abuse ranged from $1.4 billion to $2.1 billion, representing from 2.8 per cent to 4.3 per cent of all personal income of Minnesotans, from 32 per cent to 50 per cent of State expenditures, and from 26 to 39 times the alcohol excise tax revenues generated in 1983. Alcohol-related direct medical care costs were estimated to be at least $216 million, 3.8 per cent of Minnesota medical costs for 1983. Costs of reduced on-the-job productivity and short-term absenteeism related to alcohol abuse were estimated to be between $630 million and $1.2 billion. The documentation of the costs of alcohol abuse is an important step in the campaign to reduce alcohol-related deaths, morbidity, and health care costs. (*Am J Public Health* 1987; 77:982–986.)

## *Introduction*

The consequences of alcohol abuse are significant, not only in terms of adverse health effects and health care costs, but also in terms of lost earnings and decreased productivity. Nevertheless, these consequences are not inevitable and public health interventions have reduced morbidity and mortality associated with alcohol abuse.[1] Before planning interventions intended to reduce the burden of alcohol abuse, policy makers must be aware of the nature and extent of the problem.

In 1984, the Governor of Minnesota, recognizing alcohol abuse as a potentially preventable public health problem, directed the Minnesota Department of Health to determine the economic and social impact of alcohol abuse on the state. We examined three areas of alcohol-related disease impact: mortality costs, including years of potential life lost; morbidity costs; and social costs.[2]

## *Methods*

Alcohol-related mortality and associated economic costs were determined from a literature review and unpublished data from the Minnesota Departments of Health, Public Safety, Natural Resources, Human Services, and the Minnesota State Fire Marshal. Data from these departments were used to determine the total number of alcohol-related deaths and deaths by diagnostic category[3] in 1983. National data were used when state and regional data were unavailable.*

The number of alcohol-related motor vehicular deaths was derived from two data sources compiled by the Minnesota Department of Public Safety: autopsies done on those fatally injured in a motor vehicular crash, and police accident reports. Those with a blood alcohol concentration of 0.05 g/dl or greater at autopsy were considered alcohol-related.[4] Blood alcohol concentration was obtained on 72 per cent of those fatally injured in 1983. When no blood alcohol concentration was available, a death was considered alcohol-related if the police accident report indicated that, in the opinion of the reporting officer, the victim was impaired by alcohol at the time of the motor vehicular crash.

Deaths due to drownings and watercraft accidents were obtained from a review of data compiled by the Minnesota Department of Natural Resources. Deaths were considered alcohol-related if the report of the investigating officer indicated the presence of alcohol at the accident scene. We considered all deaths with no indication of alcohol use (affirmative or negative) to be unrelated to alcohol.

To determine the number of alcohol-related deaths from causes other than those due to motor vehicular crashes, drownings, and watercraft accidents, disease-specific alcohol-attributable percentages were derived from a review of the literature and applied to all deaths in specific diagnostic categories. The alcohol-attributable percentage was considered that portion of the disease caused by alcohol.[5] The number of alcohol-related deaths was determined by multiplying the disease-specific alcohol-attributable percentage by the number of deaths in each category (Table 1).[6–22]

Years of potential life lost were calculated using life expectancies taken from life tables for Minnesota. For those who died as a result of drowning or motor vehicular crashes, years of potential life lost were calculated for each event and summed. For those who died from all other causes, alcohol-attributable percentages were applied in five-year intervals.

Indirect mortality costs are the estimated costs of lost income and productivity resulting from premature death due to alcohol-related disease and trauma. The human capital method for valuing life and the standard procedures for calculating the present value of future earnings and household services were used.[23] A 4 per cent discount rate was used to convert projected future earnings into current-valued dollars.[24,25]

For each alcohol-related diagnosis, alcohol-related indirect mortality costs for lost earnings were calculated by five-year age increments as follows[23]:

Number of deaths × Present value of future earnings × Alcohol attributable % = Cost of lost future earnings. These costs were summed for all diagnoses.

Alcohol-related costs secondary to medical care (often referred to as direct costs)[25] include personal health care expenditures for the prevention, detection, treatment, and rehabilitation of alcohol-related diseases (hospital costs, physician fees, medication costs, nursing home costs, dental services, and other health care charges), and nonpersonal

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**TABLE 1—Alcohol-Related Mortality, Minnesota, 1983**

| Diagnostic Category/Diagnoses | Total Deaths | % Alcohol-Related | Alcohol-Related Deaths | Selected References |
|---|---|---|---|---|
| Injuries | 2047 | 31 | 638 | |
| Motor vehicular crashes | 558 | 50 | 280 | * |
| Accidental falls | 309 | 41 | 127 | 6, 7 |
| Suicide | 443 | 26 | 115 | 7, 8 |
| Injuries caused by fires | 72 | 42 | 30 | 9, 10 |
| Homicide | 76 | 42 | 32 | 6, 7, 8 |
| Drownings | 60 | 30 | 18 | * |
| Alcohol Poisoning | 9 | 100 | 9 | ** |
| Watercraft injuries | 23 | 35 | 8 | * |
| Other alcohol-related injuries | 172 | 11 | 19 | 11, 12 |
| All other injuries | 325 | 0 | 0 | |
| Digestive Diseases | 1132 | 22 | 251 | |
| Alcoholic cirrhosis | 140 | 100 | 140 | ** |
| Other cirrhosis | 194 | 50 | 97 | 11, 12, 13 |
| Acute pancreatitis | 29 | 41 | 12 | 14, 15 |
| Chronic pancreatitis | 3 | 67 | 2 | 15, 16 |
| All other digestive diseases | 766 | 0 | 0 | |
| Neoplasms | 7399 | 2 | 153 | |
| Cancer of esophagus | 104 | 75 | 78 | 17, 18 |
| Cancer of oral cavity | 100 | 47 | 47 | 17, 19, 20 |
| Cancer of larynx | 45 | 49 | 22 | 17, 19, 20 |
| Cancer of liver | 39 | 15 | 6 | 19, 21 |
| All other cancers | 7111 | 0 | 0 | 19, 22 |
| Mental Disorders | 263 | 22 | 57 | |
| Alcoholic psychoses | 5 | 100 | 5 | ** |
| Alcoholism | 44 | 100 | 44 | ** |
| Alcohol abuse | 8 | 100 | 8 | ** |
| All other mental disorders | 206 | 0 | 0 | |
| All Other Diagnostic Categories | 23,060 | 1 | 11 | |
| Alcoholic cardiomyopathy | 9 | 100 | 9 | ** |
| Respiratory tuberculosis | 8 | 25 | 2 | 11, 12 |
| Other diagnoses | 23,043 | 0 | 0 | |
| TOTALS | 33,901 | 3 | 1110 | |

*Minnesota surveillance data.
**Alcohol-related by definition.

costs such as health insurance administration costs, research, and medical facilities construction costs (see Appendix).

To provide a range of estimates, two methods were used to calculate personal medical costs, i.e., one using morbidity and the other mortality data. A third method was used to calculate nonpersonal costs (see Appendix).[2,6–30]

Six categories of alcohol-related social costs were considered: 1) reduced productivity; 2) motor vehicular-related property damage and insurance; 3) incarceration; 4) fires; 5) fetal alcohol syndrome; and 6) child abuse.

The estimate for reduced productivity reflects both excess short-term absenteeism[31,32] and on-the-job reductions in productivity[11,33] due to alcohol abuse. The estimated decrease in on-the-job productivity ranges from 14 per cent to 21 per cent.[11,33,34] The 14 per cent estimate was derived by Berry and Boland and adjusted for sociocultural differences.[33,34] The 21 per cent estimate was derived from multivariate analysis of the National Institute on Alcohol Abuse and Alcoholism survey data[35] on alcohol use and controlled for age, gender, race, marital status, education, and occupation.

The number of workers in each cohort was obtained from the Minnesota Department of Labor.[36] The proportion of workers in each age-gender cohort with alcohol abuse problems was derived by the Research Triangle Institute from the 1979 National Household Survey on Alcohol Abuse. Four symptoms were found to be related to decreased productivity: binge drinking, tardiness or absence from work due to hangover, alcohol-related marital problems, and arrests for drinking and driving.[11] Earnings, wage supplements, and imputed household value, were estimated for each age-gender cohort. Part-time workers were assumed to work half-time.[23,37,38]

For each age-gender cohort, the following calculations for reduced productivity were made:

Number of people in the work force × Proportion of workers with alcohol abuse problems × Earnings × Productivity decrease attributable to alcohol = Cost of alcohol-related reduced productivity

Four estimates of alcohol-related productivity losses were computed: lost income due to alcohol abuse was estimated at both 14 per cent and 21 per cent of on-the-job productivity and these percentages were applied to two income estimates, including and excluding imputed household value.[11,33,34] Costs were then summed for all age-gender cohorts. Additional costs due to long-term disability from alcohol-induced illness, trauma, and residential treatment for alcoholism were extrapolated from national data.[11]

Alcohol-related motor vehicular crashes were grouped into five categories, i.e., those with: a death, incapacitating injury, non-incapacitating injury, possible injury, and property damage only.[4] For each category, wage losses, medical expenses, insurance and property damage costs were calculated.[39] Alcohol-related property and insurance costs were summed separately to avoid duplicating medical and mortality costs presented previously.

The number of driving-while-intoxicated and liquor-law offenses, as well as the cost per offense, was obtained from the Minnesota Department of Public Safety. This cost estimate included police patrol, processing, and prosecution, but not incarceration (personal communication, Minnesota Department of Public Safety). The per diem incarceration cost for these offenses was averaged for all counties based on the number of days served per offense and the county cost per day. These figures were obtained from the Minnesota Department of Corrections and from site visits to regional workhouses.

The State Fire Marshal attributed $41 million in property damage to residential and lodging fires in 1983.[40] It was estimated that 7.1 per cent of these fire losses could be attributed to alcohol involvement.[10]

The annual number of cases of fetal alcohol syndrome was estimated by applying the national rate of three fetal alcohol syndrome cases per 1,000 live births[41] to the number of births in Minnesota (65,559) in 1983. This estimate included both full and partial expression of fetal alcohol syndrome characteristics. Using this estimate, approximately 200 Minnesota children were born with full or partial fetal alcohol syndrome.

Factors considered in determining the costs of fetal alcohol syndrome included the type and cost of lifetime diagnosis, treatment, care, and services of the most common birth defects associated with fetal alcohol syndrome[11,12] as applied to prevailing Minnesota rates for care and service in 1983 (unpublished data, Minnesota Department of Public Welfare, 1983).

The cost of social services to the group defined as families experiencing child abuse or neglect was estimated to be $64 million in 1983. Based on previously reported studies of alcohol-associated child abuse, alcohol was estimated to be involved in 27 per cent of these cases.[42]

**TABLE 2—Alcohol-Related Years of Premature Life Lost (YPLL) in Minnesota, 1983**

| ICD Code No. | Diagnostic Category | Male YPLL | | Female YPLL | |
|---|---|---|---|---|---|
| | | Years | Per Cent | Years | Per Cent |
| 001–139 | Infectious Diseases | 15 | 1 | 11 | 1 |
| 140–239 | Neoplasms | 1,681 | 7 | 635 | 7 |
| 290–319 | Mental Disorders | 1,062 | 4 | 402 | 4 |
| 390–459 | Circulatory System | 182 | 1 | 28 | 1 |
| 520–579 | Digestive System | 3,402 | 14 | 2,298 | 24 |
| E800–999 | Injuries | 17,929 | 74 | 6,264 | 65 |
| TOTAL | | 24,271 | 100 | 9,638 | 100 |

**TABLE 3—The Cost of Alcohol Abuse in Minnesota, 1983**

| Category of Cost | Value of Losses (in 1983 US dollars) |
|---|---|
| Mortality Costs (Indirect) | 320,000,000 |
| Medical Care Costs (Direct) | |
| Treatment | 195,000,000– 363,000,000 |
| Support | 11,000,000 |
| Social Costs (Direct and Indirect) | |
| Reduced productivity employment losses | 630,000,000–1,194,000,000 |
| Long-term disability | 72,000,000 |
| Motor Vehicular Crashes (Property and insurance only) | 40,000,000 |
| Driving and Liquor Law Offenses | 51,000,000 |
| Fires (Property damage only) | 3,000,000 |
| Fetal Alcohol Syndrome | 42,000,000 |
| Child Abuse | 17,000,000 |
| Total Costs (Without employment and long-term disability losses) | 679,000,000– 847,000,000 |
| Total Costs (With employment and long-term disability losses) | 1,381,000,000–2,113,000,000 |

*Results*

Of the 33,901 deaths in Minnesota in 1983, 1,110 (3.3 per cent) were alcohol-related (Table 1). Fatal injuries accounted for 638 (57.5 per cent) of statewide alcohol-related deaths (Table 1). Of the 558 motor vehicular fatalities reported to the Minnesota Department of Public Safety, 280 (50 per cent) were alcohol-related. Blood alcohol concentration was over 0.05 g/dl for 155 (55 per cent), and 125 (45 per cent) were reported by police as intoxicated.

Of the 60 drowning deaths, 18 (30 per cent) were alcohol-related. Similarly, of the 23 watercraft deaths, 8 (35 per cent) were alcohol-related. This assumed there was no alcohol involvement in drowning and watercraft deaths for which there was no information on alcohol use (Table 1).

There were age- and gender-specific differences in the rate of alcohol-related mortality. The greatest number of deaths occurred in people over 55 years of age. However, the proportion of alcohol-related deaths was highest for adolescents and young adults. There were over 350 alcohol-related deaths per 1,000 persons who died between 15 and 24 years of age compared to fewer than 10 per 1,000 deaths for those 75 and older.

Overall, there were an estimated 289,139 person-years of potential life lost from all causes in Minnesota in 1983. Alcohol contributed to 33,090 (12 per cent) of these years of potential life lost. The major contributor to alcohol-related death was injury which accounted for 7 per cent of all years of potential life lost and 68 per cent of alcohol-related years of potential life lost in Minnesota (Table 2).

The estimated 1,110 alcohol-related deaths for 1983 represented the equivalent of $320 million in lost future earnings in present valued (1983) dollars (Table 3).

In 1983, Minnesota health care costs were estimated at $5.7 billion.[27] According to the mortality comparison method, alcohol-related medical care costs were $363 million (6.4 per cent), and by the morbidity comparison method, alcohol-related costs ranged from $195 million to $288 million (3.4–5.1 per cent) of total health care costs.

Using data compiled by the Chemical Dependency Program Division of the Minnesota Department of Public Welfare, it was estimated that $107 million of these medical costs resulted from alcohol and combined alcohol/drug abuse treatment costs. Alcohol-related support costs which include the costs of program and health insurance administration, research, and medical facilities construction were estimated at $11 million.

Estimates for reduced productivity ranged from $630 million, using a 14 per cent reduction in productivity and without including imputed household value, to $1.19 billion, using a 21 per cent reduction in productivity and including imputed household value. These calculations were adjusted for age, gender, and employment rates.

Property damage and insurance costs from alcohol-related motor vehicular crashes were estimated at $40 million. In addition, there were 41,311 driving-while-intoxicated and liquor-law offenses accounting for 33 per cent of all arrests and 193,000 days of incarceration. Each arrest cost an estimated $1,052, and each day of incarceration $38. The combined cost for these offenses was $51 million. Alcohol-related fires cost an estimated $3 million. Approximately 200 children were born with fetal alcohol syndrome. Care for these children was estimated at $42 million, and alcohol abuse contributed to an estimated $17 million of the known cost of child abuse.

Our study shows that the total cost of alcohol-related problems in Minnesota was between $1.4 and $2.1 billion for 1983. To put this figure in perspective, it represents between 2.8 per cent and 4.3 per cent of personal income (i.e., non-farm income was approximately $49.4 billion). This amount also represents between 26 and 39 times the revenues generated by excise taxes on alcohol for 1983 (i.e., $53.3 million), and is an amount equivalent to between 32 and 50 per cent of all state expenditures for 1983 (i.e., $4.24 billion). Low-range summary estimates of $206 million for medical costs represent 3.8 per cent of personal health care expenditures for Minnesota in 1983.

Minnesota and national alcohol-related cost estimates are similar in both methodology and the distribution of costs. The low-range summary estimate of $206 million (3.8 per cent) for medical costs corresponds to the national figure of $9.5 billion, representing 4.3 per cent of 1980 US personal health care expenditures ($219.4 billion).[12] Minnesota indirect mortality costs of $320 million contributed between 15 and 23 per cent of alcohol costs; national costs associated with alcohol-related mortality ($14.5 billion) represented 16.2 per cent of total costs. The productivity loss estimate coupled with long-term disability costs represented between 50 per cent and 60 per cent of Minnesota costs and approximately 61 per cent of national cost estimates.

*Discussion*

Cost-of-illness studies provide a comprehensive framework for estimating alcohol-related costs. The Minnesota

survey again emphasizes that a study of alcohol-related costs should not be restricted to medical costs attributed to alcohol abuse but should include productivity losses and societal costs in order to gain a better perspective on the true costs of alcohol abuse.

Sources of error in the computation of alcohol-related costs include:

- imprecision in alcohol-attributable percentage estimates for both morbidity and mortality;
- incomplete data on the patterns of medical care utilization by level of habitual alcohol consumption;
- the coarse aggregation of economic data into large disease categories; and
- error in underlying assumptions such as the discount rate and imputed household value.

Estimates of alcohol-attributable percentages for both morbidity and mortality from alcohol-related diagnoses need refinement. The two components of the attributable risk calculation—prevalence and relative risk—are inadequately measured due to inconsistent definitions of alcohol abuse and inconsistent measures of alcohol consumption. For a number of diagnoses, relative risk data are based upon clinical case or autopsy series rather than epidemiologic investigations. When relative risk data exist they are rarely age- and gender-specific. Finally, for the calculation of direct health care treatment costs, the proportion of cases attributable to alcohol is presented as a range, often of great breadth.

Application of mortality ratios (alcohol-related deaths/total deaths) to the problem of alcohol abuse appears to be insufficient to estimate costs, since most of the costs of alcohol abuse arise from nonfatal disease and injury. Use of morbidity ratios (alcohol-related patient days/total patient days) may provide a partial solution, allowing estimates of costs to reflect actual use of inpatient services. However, two limitations remain:

- patient days must be multiplied by the best available attributable-risk estimates (and those estimates are poor); and
- morbidity ratios for inpatient hospitalization are imperfect measures of other medical care utilization

It became apparent during this study that surveillance data on alcohol abuse and alcoholism are inadequate despite the fact that these problems have a large social and economic impact. Although this report evaluated many social problems, there is no measure of alcohol as a cause of pain and suffering. The documentation of the consequences of alcohol abuse is an important step toward reducing alcohol-related morbidity and mortality. To aid state-based cost estimates, data collected by state agencies on motor vehicular crashes, fires, injuries, violence, divorce, child abuse, and other anti-social behaviors should include the role of alcohol involvement. Finally, alcohol should be included on death certificates as an underlying or contributing cause of unnatural death when the physician feels it was contributory.

This report on alcohol-related morbidity was patterned after an earlier report on smoking generated by the Minnesota Department of Health in 1983 and released in 1984.[27] This earlier report was distributed to state legislators and, in response, the 1985 legislative assembly passed the Omnibus Nonsmoking and Disease Prevention Act.[43] This Act funded statewide smoking intervention curricula for Minnesota youths, promoted nonsmoking campaigns and intervention efforts, and raised state excise taxes on cigarettes. Similarly, the report on alcohol-related morbidity and mortality has recently been distributed to all state legislators. In recent months it has been used to support legislation regarding an increase in excise taxes on alcohol and an increase in the legal drinking age. In addition, the report has been used in budget hearings related to alcohol treatment and prevention. In order to direct public health interventions and educate policy makers, more resources are needed to improve the type and quality of data collected.

## APPENDIX

The computations of personal medical and nonpersonal medical support costs were made in the following manner:

### *Mortality Comparison Method*

For each disease, alcohol-related costs were calculated by multiplying the ratio of alcohol-related deaths to total deaths (as determined previously) by the estimated 1983 health care costs within six diagnostic groups (infectious diseases, injuries, digestive diseases, cancers, mental disorders, and diseases of the heart).[26,27] Costs by diagnostic group were obtained by distributing estimated total 1983 Minnesota health costs[28] according to the distribution of 1980 US health care costs obtained from the National Center for Health Statistics.[29] All costs were summed.

### *Morbidity Comparison Method*

Because a large share of alcohol-related use of medical services is for nonfatal injury and illness, a "morbidity comparison" calculation was used. In this method, patient days for alcohol-related diagnoses were determined using hospitalization data from the Commission on Professional and Hospital Activities. These data divide all diagnoses into approximately 400 categories and provide tabulations of episodes of care and average lengths of stay for a large sample of US hospitals.[30] For alcohol-defined diagnoses such as alcoholism, all patient days were considered alcohol-attributable. For other alcohol-related diagnoses, patient days were multiplied by low, middle, and high estimates of alcohol attributable percentages.[11] Alcohol-attributable patient days were computed as (episodes of care) × (average length of stay) × (alcohol-attributable per cent). Total patient days were computed as (episodes of care) × (average length of stay).

Minnesota 1983 health-care costs were distributed among diagnostic groups as described in the mortality comparison method, based on 1980 national cost data. For each disease category, the following sequence of calculation was made:

Alcohol-related patient days ÷ Total patient days × Health care costs for the diagnostic group = Cost of alcohol-related patient days

The costs for each diagnostic group were then summed to produce total alcohol-related costs. This final step was performed separately for the low, middle, and high range estimates.

### *Medical Support Costs*

Alcohol-related medical support costs were comprised of block grant and National Institutes of Health (NIH) funding for alcohol research and a prorated estimate of health insurance and program administration costs. For the latter, it was assumed that alcohol contributed to 3.8 per cent of costs, the lower limit of alcohol-related medical care costs.

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## Insights Invited on Communication Management in Degenerative Diseases

The International Project on Communication Aids for the Speech-Impaired (IPCAS) has chosen for its 1987 Fellowship Report the topic of communication management in degenerative diseases. IPCAS is a project which operates under the auspices of Rehabilitiation International through the International Commission on Technical Aids, Building and Transportation (ICTA). It involves three countries: Canada, the United States, and Sweden.

The report will examine the problems of and the options available to people with degenerative diseases where the prognosis involves progressive neuromuscular deterioration affecting communication and swallowing capacity. Included are amyotrophic lateral sclerosis, Parkinson's disease, multiple sclerosis, muscular dystrophy, Huntington's disease, myaesthenia gravis, and cerebellar degeneration.

If you have an interest in the management of degenerative diseases and have opinion, practice, or insight you are willing to share, please contact: Susan Carroll-Thomas, Communication Disorders, Royal Ottawa Regional Rehabilitation Centre, 505 Smyth Road, Ottawa, Ontario K1H 8M2, Canada. Tel: (613) 737-7350 ext. 555.